Universidad de Antioquia
Software Engineering Department
2508901 - Deep Learning Fundamentals

Report n°1

Wind Turbine Classification using Convolutional Neural Networks (CNN)

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1. Application Context

As climate change worsens, the engineering challenges become increasingly complex given the lack of resources and budget. A transition to renewable energies is essential for a viable continuity in industrial production and consumption. Among these energies is wind energy, which is based on the kinetic energy provided by wind currents to wind turbines to generate electricity.

More and more states and private companies are investing in renewable energies and building huge wind turbines plants [1]. Therefore, it has become a necessity to account for and locate these turbines for power production forecasting. This can be achieved through the use of deep learning techniques.

In this project the implementation of a Convolutional Neural Network (CNN) for wind turbine classification is proposed to overcome this issue. The Kaggle related work [2], based on Pytorch, is going to be used as a reference in order to compare results.

2. Objectives

1. The model must predict if there is a turbine or not (background), based on the supplied image. Label is supplied according to the corresponding path it has on the dataset, in order to check accuracy.
2. Compare the performance of the model with that of the reference model based on established metrics.
3. Establish the advantages and disadvantages of Tensorflow implementation compared to Pytorch, based on the results.

3. Dataset

the Kaggle Airbus SPOT satellite images dataset [1] is going to be used. The patch of satellite images extracted with or without wind turbines with the size of 128 x 128 pixels (See Figure 1). Images are extracted from satellite acquisitions from the Airbus SPOT6 and SPOT7 satellites with 1.5 m resolution. Therefore, each patch covers roughly 192 meters on the ground [3].

The dataset is in two categories in train and validation. Training data includes 154942 patches with turbines and 202565 without. Validation data also includes 30991 and 40513 patches with and without turbines, respectively [3].

4. Performance Metrics

According to the referenced work, an overall accuracy of 99 % was reached; based on the precision, accuracy, recall, F1-score and confusion matrix metrics. In order to compare both results, these metrics are going to be used as well.

Referencias

[1] Airbusgeo. Airbus wind turbines patches, Oct 2020. URL: https://www.kaggle.com/datasets/airbusgeo/airbus-wind-turbines-patches/data.

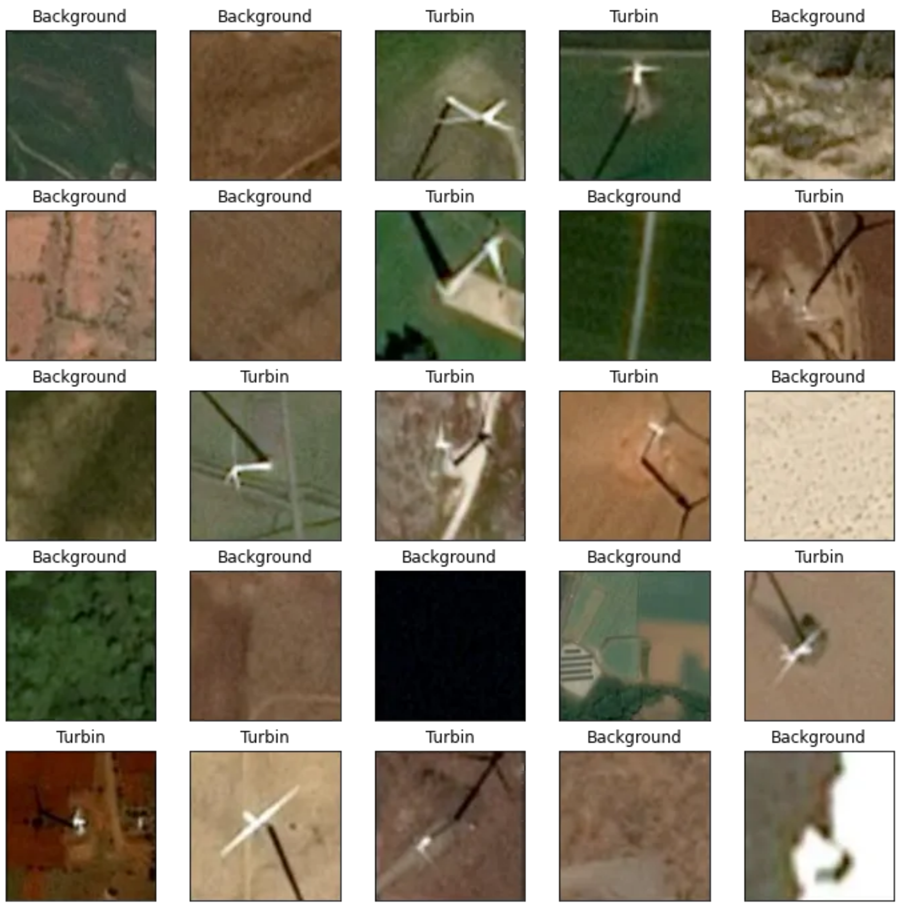

Figura 1: Patches with and without turbines for train datasets

[2] behzad89. Wind turbines classification using satellite images. URL: `https://github.com/behzad89/Wind_Turbines_Classification/tree/main`.

[3] Behzad Valipour Shokouhi. Wind turbines classification using satellite images, Sep 2022. URL: `https://medium.com/@b.valipour.sh/wind-turbines-classification-using-satellite-images-944b62356c06`.